**REMARKS**

Applicants carefully considered the Office Action mailed on October 6, 2005. In the Office Action, claims 1-21 were rejected. By the present Response, claim 1 is amended. Upon entry of the amendments, claims 1-21 will remain pending in the present patent application. Reconsideration and allowance of all pending claims are requested in light of the above amendments and in view of the arguments herein below.

**Rejections Under 35 U.S.C. § 102**

The Examiner rejected claims 1-6, 17, 19 and 21 under 35 U.S.C. §102(b) as being anticipated by Lien (US Patent No. 6,004,464), hereinafter Lien. Further, claims 1-6, 17, 19, 21 were also rejected under 35 U.S.C. §102(b) as being anticipated by Brigano et al. (US Patent No. 5,254,257), hereinafter Brigano. A prima facie case of anticipation under 35 U.S.C. § 102 requires a showing that each limitation of a claim is found in a single reference, practice or device. Applicants respectfully traverse this rejection because Lien or Brigano does not teach or otherwise disclose each and every element of claims 1-6, 17, 19 and 21.

Claims 1-6

Independent claim 1 was rejected as anticipated by Lien and Brigano. Amended claim 1 recites a water softener that includes a cation exchange resin tank fluidly coupled for passing spent brine comprising monovalent and divalent ions and a fluid mixer valve coupled to the resin tank and to a water tank to dilute the spent brine to a desired concentration of a regenerant salt. The water softener also includes an ion-separation device fluidly coupled to the fluid mixer valve to receive the diluted spent brine and separate the diluted spent brine into first and second streams, the first of the streams substantially comprising monovalent ions and the second of the streams substantially comprising divalent ions. Further, a reverse osmosis (RO) membrane is fluidly coupled

to the ion-separation device to receive the first of the streams from the ion-separation device and to reconstitute the brine for reuse.

Lien discloses a method of reclaiming spent aqueous brine solutions used in the regeneration of water-softening resins. An aqueous solution chloride or other brine is ***acidified*** with HCl to a pH of between 0.5 and 6 and a soluble sulfate salt is added together with a precipitation inhibitor. Further, Lien discloses pumping the spent brine through a spirally-wound nanofiltration membrane device that removes at least 90% of the divalent hardness while allowing passage therethrough of at least about 90% of the monovalent cations.

Applicants respectfully submit that Lien teaches addition of a soluble sulfate salt, an acid and an antiscalent to prevent scale formation during nanofiltration of the spent brine to remove the divalent ions. In particular, the combination of these additional elements is employed to prevent the precipitation of hardness onto the membrane surfaces and to facilitate the separation of other polyvalent ions. However, Lien does not teach dilution of the spent brine prior to separation of the spent brine into first and second streams having monovalent and divalent ions respectively. Furthermore, Lien does not teach a reverse osmosis (RO) membrane fluidly coupled to the nanofiltration membrane to receive the first of the streams from the nanofiltration membrane and to reconstitute the brine for reuse.

Brigano discloses a method of purifying spent brine from the regeneration of ion exchange resin. The method includes ***acidifying*** the spent brine to a pH of less than 3 with an acid other than sulfuric acid and passing the brine through a nanofiltration membrane to purify the brine by separating from it a waste stream that comprises the majority of polyvalent ions.

Clearly, Brigano also relies on the acidification of the spent brine for controlling the precipitation and preventing scale formation during nanofiltration of the spent brine to remove the divalent ions. However, Brigano does not teach dilution of the spent brine prior to separation of the spent brine into first and second streams having monovalent and divalent ions respectively. Furthermore, Brigano does not teach a reverse osmosis (RO) membrane fluidly coupled to the nanofiltration membrane to receive the first of the streams from the nanofiltration membrane and to reconstitute the brine for reuse.

Applicants submit that the presently claimed invention teaches the dilution of the brine to operate below the solubility limit of the precipitating salts to control their precipitation, thereby preventing the scale formation that is formed due to the presence of high concentration of calcium and/or magnesium that is removed during regeneration of the water softener with the brine. Advantageously, the separation of ions in diluted streams with membranes requires relatively less applied pressure that required for separation of ions in the case of undiluted concentrated brine solution. Furthermore, the purified spent brine from the nanofiltration membrane is concentrated using RO filtration where water is removed from the diluted purified brine and the salt is discharged into the reject stream from the RO membrane. Clearly, Lien or Brigano does not teach such an arrangement.

Claims 2-6 are further directed to separation of the spent brine through the arrangement of claim 1. For example, as emphasized in Applicant's claim 2 the ion-separation device comprises a nanofiltration membrane. Further, as recited in claims 3 and 4 the first of the streams comprises regenerated brine and is coupled to a brine storage tank for further reuse and the second of the streams comprises a dischargeable stream comprising hardness-causing ions. Additionally, claims 5 and 6 recite the monovalent ions being selected from the group consisting of sodium and chloride and the divalent ions being selected from the group consisting of calcium, magnesium and carbonates.

Applicants submit that at the very least Lien or Brigano do not teach dilution of the spent brine prior to separation of the spent brine into first and second streams. Furthermore, these references do not teach a reverse osmosis (RO) membrane fluidly coupled to the nanofiltration membrane to receive the first of the streams from the nanofiltration membrane and to reconstitute the brine for reuse. Therefore, for at least these reasons, Applicants submit that independent claim 1 is allowable and respectfully request the Examiner to reconsider rejection of the claim. As claims 2-6 depend from claim 1, Applicants submit that these claims are similarly allowable for at least the reasons set forth above with respect to claim 1.

Claims 17, 19, 21

Claim 17 recites a method for purifying and recycling spent brine in a water softener. The method includes passing from a cation exchange resin tank spent brine comprising monovalent and divalent ions and diluting the spent brine to a desired concentration of a regenerant salt. The method also includes separating the diluted spent brine into first and second streams, the first of the streams substantially comprising monovalent ions and the second of the streams substantially comprising divalent ions.

As discussed with reference to claim 1, Lien teaches addition of a soluble sulfate salt, an acid and an antiscalent to prevent scale formation during nanofiltration of the spent brine to remove the divalent ions. Further, Brigano also teaches the acidification of the spent brine for controlling the precipitation and preventing scale formation during nanofiltration of the spent brine to remove the divalent ions. However, neither of these references teach dilution of the spent brine prior to separation of the spent brine into first and second streams having monovalent and divalent ions respectively.

Accordingly, for at least the reasons set forth above, Applicants submit that Lien and Brigano do not anticipate claim 17. Therefore, for at least these reasons, Applicants submit that independent claim 17 is allowable and respectfully request the Examiner to reconsider rejection of the claim. Further, as claims 19 and 21 depend from claim 17, Applicants submit that these claims are similarly allowable for at least the reasons set forth above with respect to claim 17.

**Rejections Under 35 U.S.C. § 103**

The Examiner rejected claims 7-8, 14, 16 and 17-20 under 35 U.S.C. §103(a) as being unpatentable over Brigano. Claims 9-13, 15, 18 and 20 were rejected under 35 U.S.C. §103(a) as being unpatentable over Brigano in view of Hassan (US Patent No. 6,508,936), hereinafter Hassan and Guillhen (US Patent No. 4,806,244), hereinafter Guillhen.

Claims 7-8 and 14-16

Claim 7 recites a water softener that includes a cation exchange resin tank fluidly coupled for passing spent brine comprising monovalent and divalent ions and a fluid mixer valve coupled to the resin tank and to a water tank to dilute the spent brine to a desired concentration of a regenerant salt. The water softener also includes an ion-separation device fluidly coupled to the fluid mixer valve to receive the diluted spent brine and separate the diluted spent brine into first and second streams. The first of the streams substantially comprises monovalent ions and the second of the streams substantially comprises divalent ions.

As noted above, Brigano teaches the regeneration of spent brine with nanofiltration and recirculation of the regenerated brine. However, Brigano does not teach a fluid mixer valve coupled to the resin and to a water tank to dilute the spent brine. The Examiner argued that it would have been obvious to one skilled in the art at the time

the invention was made to dilute the brine when the concentration of the recycled brine does not meet the required concentration for the ion exchange regeneration.

As described above with reference to claims 1 and 17 the presently claimed invention teaches the dilution of the spent brine to facilitate operation below the solubility limit of the precipitating salts to control the precipitation, thereby preventing the scale formation that is formed due to the presence of high concentration of calcium and/or magnesium that is removed during regeneration of the water softener with the brine. This in turn obviates the need to acidify the spent brine for example. However, Brigano employs acidification of thc spent brine for controlling the precipitation and preventing scale formation during nanofiltration of the spent brine to remove the divalent ions and does not teach or suggest dilution of the spent brine prior to separation of the spent brine into first and second streams.

Applicants respectfully submit that it would not have been obvious to one skilled in the art at the time the invention was made to employ dilution of the spent brine in addition to or in place of acidification of the spent brine to control the precipitation and scale formation. Therefore, for at least these reasons, Applicants submit that independent claim 7 is allowable and respectfully request the Examiner to reconsider rejection of the claim. Further, as claims 8, 14 and 16 depend from claim 7, Applicants submit that these claims are similarly allowable for at least the reasons set forth above with respect to claim 7.

Claims 9-13, 15,18, 20

Applicants submit that Hassan and Guillhen do not cure the deficiencies set forth above with respect to at least claims 1 and 17. Notably, that the spent brine is diluted to a desired concentration of a regenerant salt prior to separation of the spent brine into first and second streams through the nanofiltration membrane. As claims 9-13, 15, 18 and 20

depend directly or indirectly from claims 1 and 17, Applicants submit that these claims are allowable for at least the reasons set forth above with respect to claims 1 and 17.

**Conclusion**

In view of the remarks and amendments set forth above, Applicants respectfully request allowance of the pending claims. If the Examiner believes that a telephonic interview will help speed this application toward issuance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

Date: 1/6/06

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